10th Class 2014		
Physics	Group-II	
Time: 2:45 Hours	(SUBJECTIVE TYPE)	Marks: 63

Part-I

2. Write short answers to any Five (5) questions: 10

(i) Define transverse waves and longitudinal waves.

Ans Transverse waves:

Such waves in which motion of particles of medium is perpendicular to direction of motion of waves are called transverse waves.

Example:

Water waves, waves produced in string.

Longitudinal waves:

Such waves in which motion of particles of medium is parallel to direction of motion of waves are called longitudinal waves.

Examples:

Sound waves, waves produced are slinky.

(ii) Define pitch and quality.

Ans Pitch:

The characteristic of sound by which we can distinguish between a shrill and a grave sound is called pitch of sound.

Quality:

The characteristic of sound by which we can distinguish between two sounds of same loudness and pitch is called quality of sound.

(iii) Calculate frequency of a sound wave of speed 340 ms^{-1} and wavelength 50 cm.

Ans Given data:

$$v = 340\ ms^{-1}$$

$$\lambda = 50\ cm = \frac{50}{100}$$

$$\lambda = 50 \times 10^{-2}\ m$$

To find:

$$f = ?$$

Solution:

$$v = f\lambda$$

$$f = \frac{v}{\lambda}$$

By putting values, we get

$$= \frac{340}{50 \times 10^{-2}}$$

$$= \frac{340 \times 10^2}{50}$$

$$= \frac{340 \times \cancel{100}^{2}}{{}_{1}\cancel{50}}$$

$$\boxed{f = 680 \text{ Hz}}$$

(iv) Describe the factors on which a safe level of noise depends.

Ans It depends on two factors:

1. The level (volume) of noise.
2. The period of expose to noise.

(v) Describe the laws of reflection of light.

Ans There are two laws of reflection of light:

1. The incident ray, normal and reflected ray at point of incidence, all lie in same plane.
2. The angle of incidence is equal to angle of reflection. *i.e.*, $\angle\hat{i} = \angle\hat{r}$.

(vi) Define Snell's law. Write down its formula.

Ans **Snell's law:**

The ratio of sine of angle of incidence '$\hat{i}$' to sine of angle of refraction '$\hat{r}$' is always equal to a constant.

i.e., $$\frac{\sin\hat{i}}{\sin\hat{r}} = \text{constant}$$

where ratio $\frac{\sin \hat{i}}{\sin \hat{r}}$ is known as refractive index of second medium with respect to first medium. So, we have

Formula:

$$\frac{\sin \hat{i}}{\sin \hat{r}} = n = \frac{n_2}{n_1}$$

It is called Snell's law.

(vii) Describe types of reflection of light.

Ans These are of two types:

1. Regular reflection
2. Irregular reflection

1. Regular reflection:

Such a reflection in which rays of light reflect in one direction only is known as regular reflection.

2. Irregular reflection:

Such a reflection in which rays of light reflect in many directions is known as irregular reflection.

(viii) Define electric field intensity and write down its formula.

Ans "The strength of electric field at any point in space is known as electric field intensity."

Formula:

$$E = \frac{F}{q_0}.$$

Its unit is NC^{-1}.

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3. Write short answers to any Six (6) questions: 12

(i) What is difference between capacitor and dielectric?

Ans **Capacitor:**

A device used to store charge is known as a capacitor.

Dielectric:

A capacitor consists of two thin metal plates, parallel to each other separated by a very small distance. The medium between two plates is air or a sheet of some insulator. This medium is known as dielectric.

(ii) Connect three capacitors in series and draw their circuit diagram.

Ans

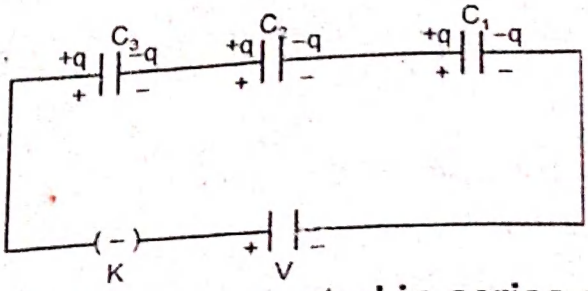


Fig: Capacitors connected in series combination.

(iii) Define electric field lines. Who introduced them?

Ans "A region around a charge in which it exerts an electrostatic force on another charge is known as electric field."

These lines were introduced by Michael Faraday.

(iv) How e.m.f of a battery is measured?

Ans In general, e.m.f means potential difference across terminals of battery, when it is not driving current in external circuit. So in order to measure e.m.f of battery, we connect voltmeter directly with terminals of battery as shown in figure.

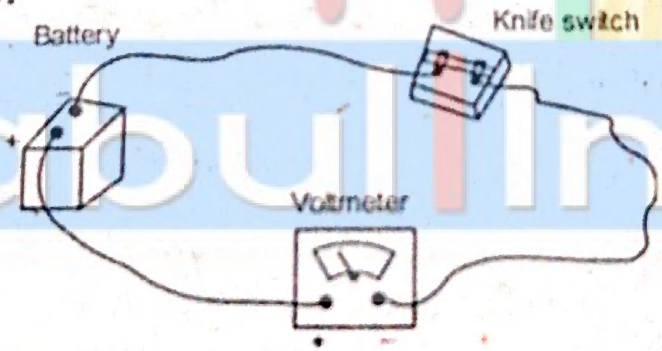


Fig: Schematic diagram for measuring e.m.f of battery.

(v) Define current. What is its SI unit?

Ans **Current:**

The rate of flow of electric charge through any cross-sectional area is called electric current.

Its formula is:

$$I = \frac{Q}{t}$$

Unit: Its SI unit is Ampere (A).

(vi) State Joule's law. Write down its formula.

Ans Joule's law:

The amount of heat energy generated in a resistance due to flow of charges is equal to product of square of current, resistance and time duration.

Formula:

Mathmatically, it is written as:

$$W = I^2 R t$$

$$W = \frac{V^2 t}{R}$$

(vii) What is difference between electric power and kilowatt hour?

Ans Electric power:

The amount of energy supplied by a current in a unit time is known as electric power.

It can be written as:

$$\text{Electrical power} = \frac{\text{Electrical energy}}{\text{Time}}$$

$$p = \frac{W}{t}$$

Unit:

Its SI unit is watt (W).

Kilowatt-hour:

The amount of energy delivered by power of one kilowatt in one hour is called kilowatt-hour.

$$1 \text{ KWh} = 3.6 \text{ MJ}$$

(viii) Write down two advantages of parallel circuit over series circuit.

Ans Parallel circuits have two big advantages over series circuit:

1. Each device in circuit receives full battery voltage.
2. Each device in circuit may be turned OFF independently without stopping current flowing to other devices in circuit. This principle is used in house wiring.

(ix) Define mutual induction.

Ans "The phenomenon of production of induced current in one coil due to change of current in a neighbouring coil is called mutual induction."

Unit: Its SI unit is Henry (H).

4. Write short answers to any Five (5) questions: 10

(i) Define A.C generator.

Ans Definition:

It consists of coil and a magnet. Thus it converts mechanical energy into electrical energy. When coil is rotated in magnetic field, current will be induced in coil. The strength depends upon number of magnetic lines of force passing through the coil. When coil rotates, induced current in it continuously changes from maximum to minimum values and vice versa.

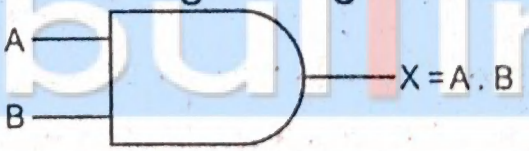
(ii) Define thermionic emission.

Ans "The process of emission of electrons from hot metal surface is called the thermionic emission."

(iii) Make the truth table and symbol of AND gate.

Ans Symbol:

The symbol of AND gate is given below:



Truth table:

The truth table of AND gate is given below:

A	B	X = A.B
0	0	0
0	1	0
1	0	0
1	1	1

(iv) What do you mean by information of technology?

Ans Definition:

The scientific method used to store information, to arrange it for proper use and to communicate it to others is called information of technology.

(v) **Write two uses of computer.**

Ans Following are the two uses of the computer:

1. Doctors use computers for diagnosing illness and treatment of disease.
2. In meteorological departments, computers are used for weather forecasting.

(vi) **Define telecommunication.**

Ans **Definition:**

The method that is used to communicate information to far-off places instantly is called telecommunication.

(vii) **Define atomic mass number and write its formula.**

Ans **Definition:**

The number of protons and neutrons in nucleus of atom is called atomic mass number.

It is denoted by A.

Example:

In nucleus of $^{14}_{7}N$, number of protons and neutrons is 14, so atomic mass number is 14.

Formula:

Atomic mass number = Atomic number + Neutron number

$$A = Z + N$$

(viii) **Define penetrating ability.**

Ans **Definition:**

The strength of radiations to penetrate certain material is known as penetrating ability.

Part-I

NOTE: Attempt any Three (3) questions.

5.(a) Write a note on the waves as carrier of energy. (4)

Ans Energy can be transferred from one place to another through waves. For example, when we shake the stretched string up and down, we provide our muscular energy to the string. As a result, a set of waves can be seen travelling along the string. The vibrating force from the hand disturbs

the particles of the string and sets them in motion. These particles then transfer their energy to the adjacent particles in the string. Energy is thus transferred from one place of the medium to the other in the form of wave.

The amount of energy carried by the wave depends on the distance of the stretched string from its rest position. That is, the energy in a wave depends on the amplitude of the wave. If we shake the string faster, we give more energy per second to produce wave of higher frequency, and the wave delivers more energy per second to the particles of the string as it moves forward.

Water waves also transfer energy from one place to another as explained below:

Drop a stone into a pond of water. Water waves will be produced on the surface of water and will travel outwards (See Fig.). Place a cork at some distance from the falling stone. When waves reach the cork, it will move up and down alongwith the motion of the water particles by getting energy from the waves.

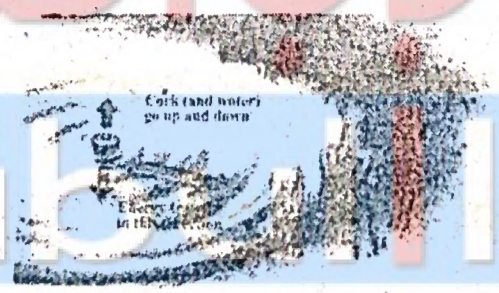


Fig. Waves.

This activity shows that water waves like other waves

- transfer energy from one place to other without transferring matter *i.e.*, water.

(b) If at Anarkali Bazar Lahore, the intensity level of sound is 80 dB, what will be the intensity of sound there? (3)

Ans **Given data:**

Intensity level of Sound = 80 dB

To find:

Intensity of Sound = ?

Solution:

Using the formula:

$$\text{Sound level} = 10 \log \frac{I}{I_o} \text{ dB}.$$

Where I_o = Faintest audible sound = 10^{-12} w/m^2.

By putting values, we get

$$80 \text{ dB} = (\log I - \log 10^{-12} \text{ w/m}^2) \text{ dB}$$

$$80 = \log I + 12 \log 10 \text{ wm}^{-2}$$

$$(8 - 12) \text{ wm}^{-2} = \log I$$

$$I = \ln (-4) \text{ wm}^{-2}$$

$$I = 10^{-4} \text{ wm}^{-2}$$

6.(a) What is the difference between magnifying power and resolving power? Explain. (4)

Ans Magnifying Power:

Let θ is the angle subtended at the eye by the object when it is placed at the near distance from eye. Let θ' is the angle subtended by the final image at the eye when the object is placed close to the eye at a distance less than f. The angular magnification (or magnifying power) M is the angular size θ' of the final image produced by the magnified glass divided by an angular size θ of the object seen without the magnifying glass.

$$M = \frac{\text{Angular size of final image produced by magnifying glass}}{\text{Angular size of object seen without magnifying glass}} = \frac{\theta'}{\theta}$$

The lens produces virtual image which is enlarged and upright with respect to the object.

If d is the near distance of the object from eye which is usually equal to 25 cm, then magnifying power becomes

$$M \approx \left(\frac{d}{f}\right) + 1$$

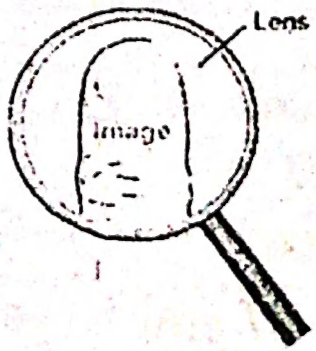


Image in a magnifying glass

Resolving power:

The resolving power of an instrument is its ability to distinguish between two closely placed objects or point sources. In order to see objects that are close together, we use an instrument of high resolving power. For example, we use high resolving power microscope to see tiny organisms and telescope to view distant stars.

(b) An object 10 cm high is placed at a distance of 20 cm from a concave lens of focal length 15 cm. Calculate position and size of image. (3)

Ans Given data:

Size of object h_o = 10 cm

Distance of object = p = 20 cm

f = –15 cm (for concave lens)

To find:

(i) q = position of image = ?

(ii) h_i = size of image = ?

Solution:

(i) Using formula:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

By putting values, we get

$$\frac{1}{q} = \frac{1}{-15\ cm} - \frac{1}{20\ cm}$$

$$= \frac{-4-3}{60\ cm}$$

$$= \frac{-7}{60\ cm}$$

$$q = \frac{60}{-7\ cm}$$

$$\boxed{q = -8.57\ cm}$$

(ii) We know that,

$$\frac{h_i}{h_o} = \frac{q}{p}$$

$$h_i = \frac{q}{p} \times h_o$$

Bu putting values, we get

$$h_i = \frac{8.57}{20} \times 10$$

$$\boxed{h_i = 4.28 \text{ cm}}$$

7.(a) Define specific resistance and prove that:

$$R = \rho \frac{L}{A}?$$ **(4)**

Ans Specific resistance (Resistivity):

A short pipe offers less resistance to water flow than a long pipe. Also the pipe with larger cross-sectional area offers less resistance than the pipe having smaller cross-sectional area. Same is the case for the resistance of wires that carry current. The resistance of a wire depends both on the cross-sectional area and length of the wire and on the nature of the material of the wire. Thick wires have less resistance than thin wires. Longer wires have more resistance than short wires. Copper wire has less resistance than steel wire of the same size. Electrical resistance also depends on temperature.

At a certain temperature and for a particular substance,

1. The resistance R of the wire is directly proportional to the length of the wire *i.e.*,

$$R \propto L \quad \ldots\ldots (1)$$

It means if we double the length of the wire, its resistance will also be doubled, and if its length is halved, its resistance would become one-half.

2. The resistance R of the wire is inversely proportional to the area of cross-section A of the wire *i.e.*,

$$R \propto \frac{1}{A} \quad \text{..... (2)}$$

It means that a thick wire would have smaller resistance than a thin wire.

After combining the two equations, we get

$$R \propto \frac{L}{A}$$

$$R = \frac{\rho L}{A} \quad \text{..... (3)}$$

where ρ is the constant of proportionality, known as specific resistance or resistivity. Its value depends upon the nature of conductor *i.e.*, copper, iron, tin and silver would each have a different values of ρ.

If we put $L = 1$ m, and $A = 1$ m^2 in eq. (3), then $R = \rho$, *i.e.*, the resistance of one metre cube of a substance is equal to its specific resistance. The unit of ρ is ohm-metre (Ω m).

(b) Two capacitors of capacitances 12 μF and 6 μF are connected in series with 12 V battery. Find the equivalent capacitance of the combination. Find the charge and the potential difference across each capacitor. (3)

Ans **Given data:**

$C_1 = 6\ \mu F$

$C_2 = 12\ \mu F$

$v = 12\ v$

To find:

(i) $C_{eq} = ?$

(ii) $Q = ?$

(iii) $V = ?$

Solution:

(i) Since capacitors are connected in series, therefore, equivalent capacitance will be:

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$$

By putting values, we get

$$\frac{1}{C_{eq}} = \frac{1}{6} + \frac{1}{12}$$

$$= \frac{2+1}{12}$$

$$= \frac{3}{12}$$

$$C_{eq} = \frac{12}{3}$$

$$\boxed{C_{eq} = 4\ \mu F}$$

(ii) Since capacitors are connected in series, therefore, charge on each capacitor will be:

$$Q = CV$$

$$Q = 4 \times 10^{-6}\ F \times 12$$

$$= 48 \times 10^{-6}\ F\ V$$

$$\boxed{Q = 48\ \mu c}$$

(iii) Potential difference across capacitor of capacitances C_1 will be:

$$Q = C_1 V_1$$

$$V_1 = \frac{Q}{C_1}$$

$$= \frac{48\ \mu C}{6\ \mu F}$$

$$\boxed{V_1 = 8\ V}$$

Similarly, potential difference across capacitor of capacitance C_2 will be:

$$Q = C_2\ V_2$$

$$V_2 = \frac{Q}{C_2}$$

$$V_2 = \frac{48\ \mu C}{12\ \mu F}$$

$$\boxed{V_2 = 4\ V}$$

8.(a) Define electromagnetic induction and explain it with example. (4)

Ans Electromagnetic induction:

Hens Christian Oersted and Ampere discovered that an electric current through a conductor produces a magnetic field around it. Michael Faraday thought that the reverse must also be true: that a magnetic field must produce an electric current. Faraday found that he could induce electric current by moving a wire through a magnetic field. In the same year, Joseph Henry also showed that a changing magnetic field could produce electric current. Now we shall discuss Faraday's experiments for the process of production of e.m.f. in magnetic field.

The strength of magnetic field is defined as the number of magnetic lines of force passing through any surface. The number of lines of force is maximum when the surface is held perpendicular to the magnetic lines of force. It will be minimum when surface is held parallel to the magnetic lines of force. If we place coil in the magnetic field of a bar magnet, some of the magnetic lines of force will pass through it. If the coil is far away from the magnet, only a few lines of force will pass the coil Fig (a). However, if the coil is close to the magnet, a large number of lines of force will pass through it (Fig. b).

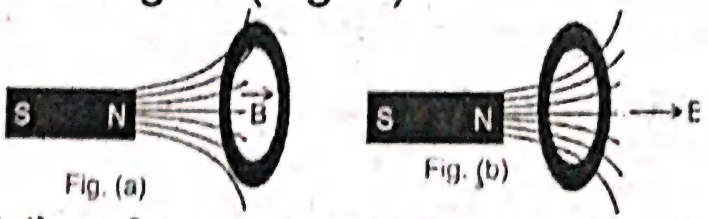


Fig. Variation of magnetic field lines of force through a coil placed at different distances from the magnet.

This means, we can change the number of magnetic lines of force through a coil by moving it in the magnetic field. This change in the number of magnetic field lines will induce an e.m.f. in the coil. This is the basic principle of production of electricity and working of transformer.

Take a rectangular loop of wire and connect its two ends with a galvanometer. Now hold the wire stationary or move it parallel to the magnetic field of a strong u-shaped magnet. Galvanometer shows no deflection and hence there is no current. Now move the wire downward through the field, current is induced in one direction as shown by the deflection of the galvanometer (Fig. a, b). Now move the wire upward through the field, current is induced in the opposite direction (Fig. b).

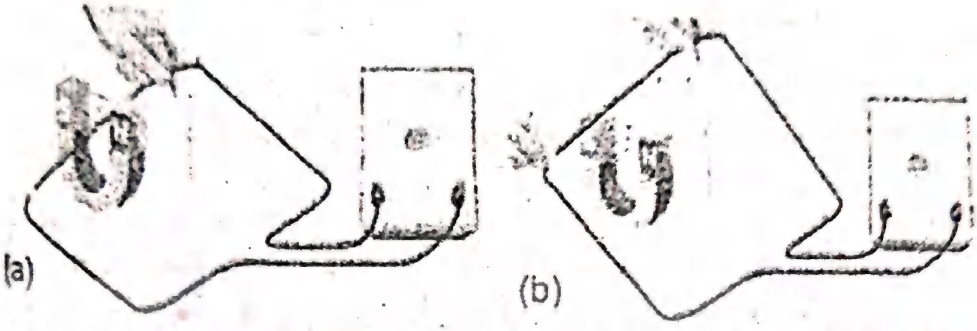


Fig. Demonstration of electromagnetic induction by the movement of a wire loop in the magnet field.

It implies that an electric current is generated in a wire only when the wire cuts magnetic field lines. This induced current is generated by the induced e.m.f. in the circuit. Faraday found that to generate current, either the conductor must move through a magnetic field or a magnetic field must change across the conductor. Thus,

"The process of generating an induced current in a circuit by changing the number of magnetic lines of force passing through it is called electromagnetic induction."

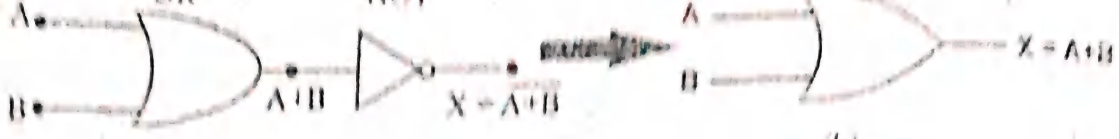
(b) Write down the expression and truth table of NOR gate.

Ans NOR gate:

The NOR operation is simply an OR operation followed by a NOT operation. The NOR gate is obtained by coupling the output of the OR gate with the NOT gate. Thus, for the same combination of inputs, the output of a NOR gate will be opposite to that of an OR gate. Its Boolean expression is

$$X = \overline{A + B}$$

It is read as X equals A OR B NOT. The symbol and truth table of NOR gate are given below:



(a) (b)

Truth table for NOR operation		
A	B	$X = \overline{A + B}$
0	0	1
0	1	0
1	0	0
1	1	0

9.(a) Write note on components of computer-based information system. (4)

Ans There are five parts of Computer-based information system (CBIS). These are called the components of information technology.

1. Hardware:

The term hardware refers to machinery. This includes the central processing unit (CPU) and all of its support equipments, input and output devices, storage devices and communication devices.

2. Software:

The term software means the computer programs and the manuals that support them. Computer programs are machine-readable instructions that direct the circuitry within the hardware parts of the CBIS to produce useful information from data.

3. Data:

Data are facts and figures that are used by programs to produce useful information. It may be in the form of text, graphic or figure that can be recorded and that have specific meaning.

4. Procedure:

These are set of informations and rules to design and use information system. These are written in manuals and documents for use.

5. People:

Every CBIS needs people if it is to be useful, who influence the success or failure of information systems.

(b) Half-life of $^{16}_{7}N$ is 7.3s. A sample of this nuclide of nitrogen is observed for 29.2s. Calculate the fraction of the original radioactive isotope remaining after this time. (3)

Ans Given data:

$T_{1/2} = 7.3$ sec

$t = 29.2$

Original atom's = No = ?

Fractional part remaining in 29 sec.

$$\text{No. of half-life} = \frac{\text{Time}}{T_{1/2}}$$

$$= \frac{29.2}{7.3}$$

$$= 4$$

Fractional part remained after 1^{st} half-life $= \frac{1}{2}(No)$

// // // 2^{nd} half-life $= \frac{1}{2}\left(\frac{No}{2}\right)$

$$= \frac{1}{4}No$$

// // // 3^{rd} half-life $= \frac{1}{2}\left(\frac{No}{4}\right)$

$$= \frac{No}{8}$$

// // // 4^{th} half-life $= \frac{1}{2}\left(\frac{No}{8}\right)$

$$= \frac{No}{16}$$

$$= \frac{1}{16}(No)$$

Result:

$\frac{1}{16}$ part of original sample decayed after 29.2 sec.

$$N = No \times \frac{1}{2}$$

$$= No \times \frac{1}{24}$$

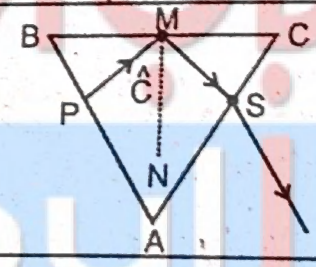
$$= \frac{1}{16} \text{ of No.}$$

Part-III (Practical Part)

Attempt any Two questions.

A Determine the critical angle and refractive index of prism, according to given information. Also define critical angle. (5)

Sr. No.	Angle PMS
1.	78°
2.	82°
3.	80°



Ans

$$\text{Critical angle } \hat{C} = \frac{\frac{78}{2} + \frac{82^o}{2} + \frac{80}{2}}{3}$$

$$= \frac{39 + 41 + 40}{3}$$

$$= \frac{120}{3}$$

$$\hat{C} = 40^o$$

$$n = \frac{1}{\sin \hat{C}} = \frac{1}{\sin 40} = 1.55$$

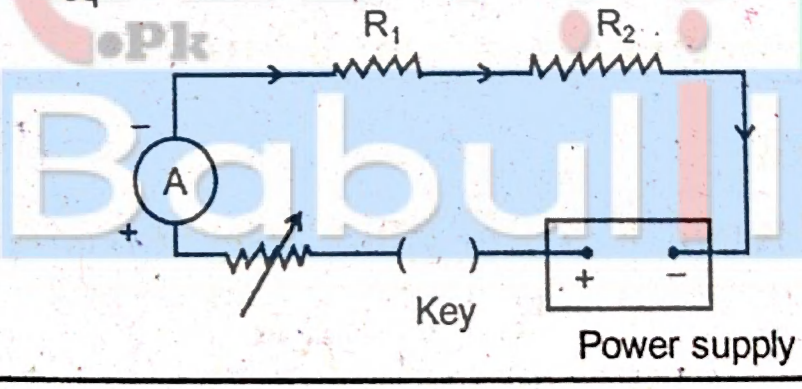
Definition:

"When a ray of light enters from denser medium to rarer medium, then angle of incidence whose angle of refraction is 90° is called critical angle."

B(i) If the two resistors have resistances R_1 = 2k Ω and R_2 = 6k Ω by using series combination, find out their equivalent resistance and also draw their diagram. (3)

Ans

$$R_1 = 2\ k\Omega$$
$$= 2 \times 10^3\ \Omega$$
$$R_2 = 6\ k\Omega$$
$$= 6 \times 10^3\ \Omega$$
$$R_{eq} = 2 \times 10^3 + 6 \times 10^3$$
$$= 8 \times 10^3\ \Omega$$
$$R_{eq} = 8\ k\Omega$$



(ii) What is difference between galvanometer and voltmeter? (2)

Ans **Galvanometer:**

It is an instrument which is used to detect current and voltage of the circuit.

Voltmeter:

It is an instrument which is used to measure the potential difference across the circuit.

C(i) Draw the diagram of NAND Gate and write its equation.

Ans Symbol:

The symbol of NAND gate is given below:

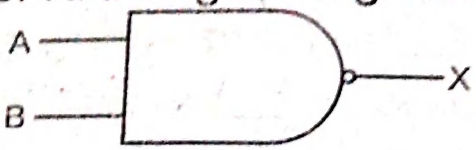
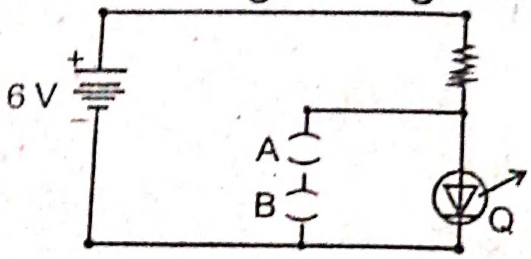


Diagram:

The diagram of NAND gate is given below:



Equation:

The boolean equation of NAND gate is given below:

$$X = \overline{A.B}$$

(ii) Write the truth table of output for NAND gate: (3)

Ans Truth table:

The truth table of NAND gate is given below:

A	B	$X = \overline{A.B}$
0	0	1
1	0	1
0	1	1
1	1	0

S_1	S_2	X(Lamp)
OFF	OFF	ON
ON	OFF	ON
OFF	ON	ON
ON	ON	OFF